

## Parasitic Helminths and Arthropods from Brazilian Free-Tailed Bats (*Tadarida brasiliensis cynocephala*) in Florida

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**ABSTRACT:** Forty-five Brazilian free-tailed bats (*Tadarida brasiliensis cynocephala*) from 5 locations in Florida were examined for parasites. Eleven species of helminths were identified and included 7 trematodes, 3 nematodes, and 1 cestode, all of which are new records for bats from Florida. The identification of the cestode *Vampirolepis decipiens* is the first record in the United States, and the identification of the trematode *Ochoterenatrema breckenridgei* is a new record for *Tadarida brasiliensis* in the United States. The nematode *Molinostrongylus delicatus* was the most prevalent helminth collected (64%). Eight species of mites were identified, with *Chiroptonyssus robustipes* being the most prevalent (100%). The mites *Ewingana* (*Ewingana*) *longa*, *Dentocarpus macrotrichus*, and *Notoedres* (*Bakeracarus*) sp. are reported for the first time infesting bats from Florida.

**KEY WORDS:** Brazilian free-tailed bat, *Tadarida brasiliensis cynocephala*, Chiroptera, trematodes, cestodes, nematodes, mites, Florida.

Brazilian free-tailed bats, *Tadarida brasiliensis cynocephala* (Le Conte, 1831), are found commonly throughout Florida, except the Florida Keys, and are 1 of the 2 species of Molossidae that occur in the state (Brown, 1987). Although the ectoparasites of Brazilian free-tailed bats from Florida have been documented, their endoparasites have not been reported (Forrester, 1992). In the United States, the helminth records for *T. brasiliensis* (Geoffroy Saint-Hilaire, 1824) are summarized by Webster (1973), and significant surveys since then include Martin (1976) and Lotz and Font (1991). Surveys have been conducted also in Jamaica (Webster, 1971), Cuba (Baruš and Valle, 1967; Groschaft and Valle, 1969; Rutkowska, 1980; Zdzitowiecki and Rutkowska, 1980), and Mexico (Caballero, 1940, 1942, 1943). *Tadarida brasiliensis cynocephala* was included in only 2 of these studies (Martin, 1976; Lotz and Font, 1991). The present report concerns the parasites of 45 *T. brasiliensis cynocephala* from Florida.

### Methods

Forty-three Brazilian free-tailed bats from north-central Florida (Alachua County [Gainesville],  $n = 33$ ; Marion County [Ocala],  $n = 7$ ; Polk County [Lake-land],  $n = 3$ ) were collected from 1992 to 1995; 1 bat from central Florida (Lake Placid, Highlands County) was collected in March 1973; and 1 bat from southern Florida (Davie, Broward County) was collected in March 1989. Two bats were examined fresh; the rest were frozen before necropsy.

Twenty-eight bats from Alachua County were ex-

amined for ectoparasites, and arthropods collected were placed in 70% ethanol. Representatives of each putative taxon were mounted on glass microscope slides in Hoyer's medium and examined with an interference contrast microscope.

All 45 bats were examined for endoparasites. Organs were separated from each other and placed into individual petri dishes; the small intestine was divided into 3 equal parts. Under a dissecting microscope, the hollow organs were incised and solid organs macerated. Cestodes and trematodes were preserved in Roudabush's alcohol/formalin/acetic acid and nematodes in 70% ethanol with glycerin. Cestodes were stained with either Harris' hematoxylin or Semichon's acetocarmine, and trematodes were stained with Semichon's acetocarmine. Nematodes were mounted in lactophenol. Helminth voucher specimens have been deposited in the Harold W. Manter Collection, University of Nebraska State Museum (Lincoln, Nebraska), and the U.S. National Parasite Collection (Beltsville, Maryland). Arthropod voucher specimens have been deposited in the U.S.D.A. National Veterinary Services Laboratories, Parasitology Reference Collection (Ames, Iowa).

### Results and Discussion

Eleven species of helminths were collected from the 45 bats. These included 7 species of trematodes, 3 nematodes, and 1 cestode (Table 1). None has been recorded previously from this host in Florida. Seven bats were free of helminths. Multiple helminth infections were as follows: 9 bats had 1 species of helminth, 11 had 2 species, 11 had 3 species, 4 had 4 species, and 3 had 5 species. A total of 804 helminth specimens was collected.

Of the helminths collected in this study, *Mol-*

Table 1. Helminths from 45 Brazilian free-tailed bats (*Tadarida brasiliensis cynocephala*) from Florida.

Helminth	Alachua County (n = 33)		Marion County (n = 7)		Polk County (n = 3)		All Bats* (n = 45)	
	% prevalence	Intensity $\bar{x}$ (range)	% prevalence	Intensity $\bar{x}$ (range)	% prevalence	Intensity $\bar{x}$ (range)	% prevalence	Intensity $\bar{x}$ (range)
<b>Trematoda</b>								
<i>Acanthiarium</i> sp. (2, 3)† (USNPC 83849–50, HWMML 37519–20)‡	9	4 (3–5)	—	—	—	—	7	4 (3–5)
<i>Limatium oklahomense</i> Macy, 1931 (1) (USNPC 83853–54, HWMML 37524–26)	36	2 (1–10)	29	4 (2–6)	67	5 (1–8)	36	3 (1–10)
<i>Paraechthodendrium chlosiolum</i> (Mehlis, 1831) (2) (USNPC 83852, HWMML 37528)	6	4 (1–7)	—	—	33	3 (—)	7	4 (1–7)
<i>Ochotreumatema breckenridgii</i> (Macy, 1936), (2, 3) (HWMML 37521)	—	—	14	6 (—)	33	2 (—)	7	4 (2–6)
<i>Ochotreumatema labda</i> Caballero, 1943 (2, 3) (USNPC 85415, HWMML 37523)	3	1 (—)	29	86 (2–171)	33	8 (—)	11	76 (1–197)
<i>Urorema scabridum</i> Braun, 1900 (3, 4) (USNPC 83851, HWMML 37527)	27	1 (1–4)	14	1 (—)	—	—	22	2 (1–4)
<i>Dicrocoelium rileyi</i> Macy, 1931 (5) (HWMML 37522)	3	3 (3)	—	—	—	—	4	7 (3–10)
<b>Cestoda</b>								
<i>Vampirolepis decipiens</i> (Diesing, 1850) (2, 3) (USNPC 83855–56, HWMML 37529–31)	30	3 (1–8)	—	—	—	—	22	3 (1–8)
<b>Nematoda</b>								
<i>Molnistrongylus delicatus</i> (Schwartz, 1927) (1, 2) (USNPC 83857–59, HWMML 37516–18)	64	6 (1–34)	29	2 (1–3)	—	—	53	6 (1–34)
<i>Capillaria</i> sp. immature (1)	15	2 (1–5)	—	—	—	—	11	2 (1–5)
<i>Physaloptera</i> sp. immature (1, 2)	33	13 (1–43)	14	1 (—)	—	—	27	13 (1–43)

\* Totals include 1 bat from Broward County, which had 1 *M. delicatus* and 197 *O. labda*, and 1 bat from Highlands County, which had 5 *O. breckenridgii* and 10 *D. rileyi*.

† Numbers in parentheses indicate locations in host: (1) stomach, (2) upper ½ small intestine, (3) middle ½ small intestine, (4) lower ½ small intestine, and (5) liver/gall bladder.

‡ Sample accession numbers: HWMML = Harold W. Manter Laboratory parasite collection, USNPC = U.S. National Parasite Collection.

*inostrongylus delicatus* had the highest prevalence (64%). This nematode is common to *T. brasiliensis* throughout its North American range, occurring in prevalences ranging from 11 to 44%.

Three bats had high numbers of physalopterid larvae encysted in their stomach walls (i.e., 37, 37, and 45 larvae). Martin (1976) reported immature *Physaloptera* sp. in *T. brasiliensis* from Texas and Louisiana, but he gave no intensities or locations within the host.

Twelve specimens of *Acanthatrium* sp. were collected from 3 bats from Alachua County. The genital atrial spines in each were arranged as a main group of spines pointing posteriorly and a smaller grouping of opposing spines pointing anteriorly. This arrangement of spines in the genital atrium closely resembled that described by Macy (1940) in what he called *Acanthatrium eptesici* Alicata from an *Eptesicus fuscus* (Palisot de Beauvois) collected in St. Paul, Minnesota. However, the *Acanthatrium* from Florida differed from Alicata's (1932) original description of *A. eptesici*. The length and width of the Florida fluke were much smaller (503 by 319  $\mu\text{m}$ ), the sizes of both the oral and ventral suckers were smaller (ratio = 1.27–1), the prostate mass was half as big (87 by 76  $\mu\text{m}$ ), the length of the atrial spines is 19–21  $\mu\text{m}$  for the anterior set of spines and 17–18  $\mu\text{m}$  for the opposing set of spines, and the testes much smaller (85 by 82  $\mu\text{m}$ ). The blunt papilla to the right of the genital atrium that was observed consistently in *A. eptesici* by Lotz and Font (1983) was absent in all of our specimens. Attempts to obtain the specimen of *A. eptesici* described by Macy (1940) for comparison were unsuccessful. The Florida specimens of *Acanthatrium* did not conform to any of the published species descriptions of *Acanthatrium*; therefore, we feel that it may be a new species. However, because our specimens were frozen, in some cases up to 4 mo, we do not feel confident about describing a new species until fresh specimens can be examined.

*Ochoterenatrema labda* Caballero was collected from 4 bats. Two bats, 1 each from Broward and Marion counties had high intensities with 194 and 171 specimens, respectively. Specimens of *O. breckenridgei* were collected from bats in Highlands, Marion, and Polk counties. This is the first record of *O. breckenridgei* from *T. brasiliensis* in the United States.

*Limatulum oklahomense* was described originally by Macy (1931) from *T. brasiliensis* cy-

*nocephala* collected from Oklahoma and Kansas with a prevalence of 3.6%. The prevalence of *L. oklahomense* in the Florida sample was much higher at 36%. Lotz and Font (1991) reported that no *L. oklahomense* were found in the 59 *T. brasiliensis cynocephala* they sampled in Louisiana.

Two cestodes are known to infect *T. brasiliensis*: *Vampirolepis gertschi* (Macy, 1947) and *V. decipiens* (Diesing). Thirty percent of the bats from Alachua County were infected with *V. decipiens* and yielded a total of 30 specimens. Diesing (1850) first described this cestode from *Tadarida laticaudata* (É. Geoffroy) in Paraguay. Previously, only *V. gertschi* was reported from *T. brasiliensis* in the United States (Cain, 1966; Martin, 1976). Cain (1966) was uncertain about the identification of the cestode he found and tentatively identified it as *V. gertschi*, even though it differed from Macy's (1947) description. This is the first published report of *V. decipiens* in the United States; it is also a new host record in *T. brasiliensis cynocephala*. However, Rogers (1965), in an unpublished master's thesis, reported *V. decipiens* in *T. brasiliensis mexicana* (Saussure, 1860) from Oklahoma, and it was the only species of cestode collected in the 898 *Tadarida* he sampled.

One insect and 8 mite species were collected from the 28 bats from Alachua County examined for ectoparasites (Table 2). Every bat was infested with at least 1 mite. Multiple arthropod infestations were as follows: 20 bats bore only 1 arthropod species, 6 had 2 species, and 2 had 3 species. A total of 1,429 arthropod specimens was collected and identified, but intensities could not be calculated because quantitative techniques were not used to obtain every parasitic arthropod from each host as they were for the parasitic helminths.

Among the collected arthropod assemblage, only 6 of the mite species are truly bat parasites; the other 3 arthropods probably were accidentally or incidentally present on the sampled bats. Two bats yielded a total of 3 individual unidentified psocids (Insecta: Psocoptera). These insects are normally free-living herbivores, fungivores, or detritivores (Mockford, 1993), with only rare occurrences noted on mammal fur (Pearman, 1960).

Two of the collected mites are either known or putative prostigmatid predators on other mites and, like the psocids, both were probably present

**Table 2.** Ectoparasites from 28 Brazilian free-tailed bats (*Tadarida brasiliensis cynocephala*) from Alachua County, Florida.

Arthropod	No. bats infested	% prevalence	No. mites collected*
<i>Chirotonyssus robustipes</i> (Ewing, 1925) (94-16229)†	28	100	67 M, 121 F, 1,227 N
<i>Dentocarpus macrotrichus</i> Dusbábek and Cruz, 1966 (94-16226)	1	3.5	1 M, 1 N, 1 L
<i>Ewingana (Doreyana) inaequalis</i> (Ewing, 1938) (94-16222)	1	3.5	1 F
<i>Ewingana (Ewingana) longa</i> (Ewing, 1938) (94-16226)	1	3.5	1 M, 2 F
<i>Ewingana (Doreyana)</i> sp. (94-16209)	1	3.5	1 F
<i>Notoedres (Bakeracarus)</i> sp. (94-16212)	1	3.5	1 F
<i>Raphignathus</i> sp. (94-16213)	1	3.5	1 F
Prostigmata: Cheyletidae (Cheyletiini) (94-16218)	1	3.5	1 M
Psocid (Insecta: Psocoptera) (94-16214)	2	7.0	3

\* F = female, M = male, L = larva, N = nymph.

† U.S.D.A. National Veterinary Services Laboratories accession numbers.

by contamination from the bats' environment. One male cheyletid mite was in poor condition and unidentifiable, although it was not *Cheletonella vespertilionis* Womersley the member of the predator family Cheyletidae most frequently associated with bats (Volgin, 1969), because it possessed eyes where *C. vespertilionis* does not. A female *Raphignathus* mite collected on another bat did not match any of the approximately 2 dozen species described in the family Raphignathidae (Robaux, 1976). Numerous parasitic mites inhabited both bats from which the 2 predaceous mites were taken.

*Chirotonyssus robustipes* (Mesostigmata: Macronyssidae) was the only mite with a prevalence of 100%. Its typical and nearly exclusive host is *T. brasiliensis*, on which it is known to breed (Radovsky, 1967). A few collections from several other bat species probably represent strays and were acquired when sharing roosts with *T. brasiliensis* (Radovsky, 1967; Durden et al., 1992). Both adults and nymphs were present on every host we examined, with 71% being the active protonymphal stage.

One female specimen of an undescribed species of *Notoedres* (Astigmata: Sarcoptidae) was collected from 1 bat. Our specimen belongs in the subgenus *Bakeracarus*, which contains the 9 described species that occur on vespertilionid and molossid bats in the United States, the neotropics, Europe, and Korea (Klompen, 1992). One species, *N. (Bakeracarus) lasionycteris* (Boyd and Bernstein), has been collected previously from *T. brasiliensis* in Cuba (Dusbábek, 1970), but our mite is different from that species.

The remaining 4 mite species collected were

astigmatid fur mites. *Dentocarpus macrotrichus* (Chirodiscidae) was represented by 3 specimens from a single bat. The type host of *D. macrotrichus* is *T. brasiliensis muscula* (Grundlach) from Cuba (Fain, 1973); it is known also from *T. brasiliensis mexicana* in Texas (McDaniel and Coffman, 1970), but this is the first record for this mite from Florida.

Three species of *Ewingana* fur mites (Myobiidae) occurred on our bats, each on a separate host individual. Two female and 1 male *E. (Ewingana) longa* coinhabited a bat with *C. robustipes* and *D. macrotrichus*. This mite was first collected and described from Berkeley, California, on *T. brasiliensis mexicana* in 1934 (Ewing, 1938). It also is known from Texas and Alabama but has not been collected before in Florida. Our second species (1 female), *Ewingana (Doreyama) inaequalis*, was first collected and described from Leon County, Florida, on *T. brasiliensis cynocephala* in 1934 (Ewing, 1938). The third *Ewingana* mite (a single female) also belongs in the subgenus *Doreyama*, but it differs from *E. inaequalis* in several respects, most notably the tarsal claws, morphology of the first pair of legs, and the structure and arrangement of the dorsal setae. Three other species of *E. (Doreyama)* were described from neotropical molossid bats, although only *E. inaequalis* is known from *T. brasiliensis*; our specimen differs from all 4 species, and it seems to represent an undescribed species.

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